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The Tracy Law Firm
5473 Blair Road, #200
Dallas, TX 75231

July 14, 2008

Attn: Mr. E. Todd Tracy

Re: **POWLEDGE vs. GENERAL MOTORS CORPORATION**

Dear Mr. Tracy,

I. ASSIGNMENT

A. Since my education, training, and experience encompasses almost all aspects of automobile design and engineering, my task in this case was to try and determine, based upon a reasonable degree of probability, whether or not a defect existed in the subject vehicle, and whether such a defect "most likely" caused the accident and the resulting deaths to the Powledge family. I say "most likely" because, although the evidence may be strong and overwhelming on a particular point, still, we may never know with "certainty" what occurred in the Powledge vehicle before the impact.

B. In ascertaining whether a defect was present in the subject vehicle, naturally, I had to first determine whether other causes of the accident existed. Although one could come up with a number of scenarios which "possibly" could have occurred, the most "probable" other such causes would have been: (1) whether this accident was intentionally caused by Mr. Powledge (i.e., whether he was committing suicide); (2) whether Mr. Powledge unintentionally caused the accident because of some physical ailment (i.e., stroke, heart attack, seizure, etc.); (3) whether the accident was caused by something inside the vehicle, like a floor mat/stuck pedal/pedal misapplication; and (4) whether an environmental, mechanical, or electrical defect existed in the vehicle that caused unwanted acceleration.

II. QUALIFICATIONS

B. My curriculum vita is attached as **Attachment A.**

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C. My expertise includes the field of automotive design analysis engineering -- the specialty of analyzing the design and performance of vehicles, including restraint systems. While employed by GM, I was assigned to the GM Safety Research and Development Laboratory (SRDL) at the GM Proving Grounds, from September 1971 through August 1978, as an engineer in the restraints, structures and analytical groups. Additionally, I was responsible for analyzing crash tests, sled tests and field performance of GM vehicles and restraint systems.

D. It has been part of my background and training to:

A. Utilize general mechanical engineering knowledge and skills, including numerous principles of the laws of physics and their application to the operation of mechanical objects.
B. Utilize special knowledge of automotive engineering, including knowledge of principles of physics and mechanical engineering, as applied to the design, manufacture and performance of automobiles and component parts, including restraint systems.
C. Utilize special background and training in principles of design and analysis of design of automotive restraint systems and the performance of automotive restraint systems:
a. In the testing environment;
b. In studying the relationship between testing and "real world/ field" performance based on testing and analysis of testing; and
c. In actual "real world" collisions.

E. Portions of my opinions are also based on a review of testing and analysis conducted by or for the National Highway Traffic Safety Administration (NHTSA) and by General Motors, as well as my own experience in the conduct and analysis of such testing. Crash, sled and component testing of restraint systems is performed to analyze the behavior of vehicle component parts under controlled laboratory conditions.

F. During the development phase of vehicle design and manufacture, such tests are routinely used by engineers to:
1. Investigate and predict the behavior of the vehicle and its components in "real world" settings;
2. Set criteria for designs; and,
3. Validate designs.

G. It is recognized as sound engineering practice to document the occurrences of failure during controlled testing, to investigate the causes of the failure, and note any corrective action taken. During my employment at GM, for example, Test Incident Reports, sometimes called Test Information Reports (TIR's), were filled out in the event of a failure and then followed-up. I have reviewed similar documents from General Motors in other litigation, which analyze vehicle test anomalies.

H. If a component fails during developmental testing, the responsible design engineer would be expected to take corrective action to control or eliminate the causes of the failure.

I. Failure during controlled testing, if not corrected, is predictive of failure under field conditions.

III. DESIGN EXPERIENCE

During my almost 40-year career, I have:

A. Designed the following prototype hardware while working for General Motors:
   1. The upward deploying air cushion passive restraint system "air pillow" used on many of today's automobiles (US Patent: 3,801,126);
   2. The steering column mounting system for the GM do Brasil Opala;
   3. The prototype steering column mounting system for the GM X body (US Patent: 4,241,937).

B. Participated in the analysis, testing and development of structural designs for the following GM vehicles:
   1. 1976-1997 G (full size) van;
   2. 1977-1990 B-C (full size) car;
   3. 1978-1986 A-G (intermediate) car; and
   4. 1980-1984 X (compact) car.

C. Analyzed the structural performance and overall crash safety assessment for the "Competitive Car Program." As part of that program I reviewed the crash test data and high speed motion pictures of both front and rear crash tests of vehicles from auto manufacturers in the US, Japan and Europe.

D. Represented General Motors on the SAE (Society of Automotive Engineers) impact simulation subcommittee.

E. Represented the GM Safety Research and Development Laboratory at the 1979 E body (sport luxury) Project Center.

F. Performed the structural analysis and testing for the Large Research Safety Vehicle (LRSV) structure at Minicars. (Struble, 1981)

G. Supervised the development of new restraint systems for the Volvo 240 series vehicle under NHTSA contract. (Foster, 1981) and presented the design proposals to Volvo for approval. Volvo adopted the design proposals and there were NO driver fatalities in 240 series vehicles on US highways for several years after their release into production. (Insurance Institute for Highway Safety, 1995)

H. Designed the roof and floor structure for the Paratransit Vehicle, a taxi to carry handicapped individuals, under contract to the Urban Mass Transit Administration. (UMTA, Struble, 1981)

I. Designed the side impact protection enhancements for the Modified Integrated Vehicle (MIV) program. (Hanneman, 1982) In the MIV program, Charles Strother and I proposed various modifications to improve the rear impact crash safety of the GM 'X' body cars, including reinforcing the seats. (Strother, 1980)

J. Continued to study the design of safety systems, particularly vehicle performance in collisions with a rearward force component, since becoming involved in the full time analysis of real world collisions. In that regard, I co-authored a Society of Automotive Engineers (SAE) paper regarding rearward force collision seat performance (Saczalski, 1993) which studied the following seat restraint system issues:
   1. The design and field performance of at least fifty different production vehicle seats from all over the world;
   2. Reviewed almost two hundred US seat design Patents and several foreign patents for automotive seats ; and
   3. Reviewed lab tests for many production seats.

K. Published papers on other automotive restraint issues through the Society of Automotive Engineers (SAE) and by the American Society of Mechanical Engineers (ASME).

L. Conducted presentations on the methodology for determining occupant kinematics and analyzing physical evidence of occupant contact. (Syson, 1999).

IV. METHODOLOGY

A. The assignment was accomplished using methods commonly accepted and used by automotive engineers who are similarly engaged in the profession of accident analysis and automotive defect analysis.

B. The opinions herein are based on my background, experience and expertise in the field of automotive design analysis engineering, and on the application of recognized laws of physics and principles of mechanical and automotive engineering applied using accepted engineering methods to the specific issues raised by the events in question.

C. The analysis I used is based on "ruling out" scenarios similar to what a physician does to make a diagnosis.

V. ANALYSIS OF AN INTENTIONAL ACTION BY MR. POWLEDGE CAUSING THE ACCIDENT

A. My analysis began with a study of the facts and physical evidence, including:

1. The police accident report, police video and scene photographs;
2. Scene photographs and video by Michael Williams taken on October 25, 2005;
3. Scene photographs and scene diagram by Scientific Analysis taken on October 30, 2005;
4. Scene photographs and video by Dr. Mike Andrews and Kirk Parks taken April 17, 2008;
5. The Galveston County Medical Examiner's Reports;
6. National Weather Service data;
7. The Malibu Classic at issue, an undamaged exemplar Malibu Classic, and an undamaged Malibu;
8. Discovery materials, including depositions from this and other cases;
9. Literature regarding brake systems, speed controls, cruise controls, and other causes of stuck throttle;
10. NHTSA customer reports for other vehicle speed control failures;
11. NHTSA recalls on cruise control systems; and
12. Medical / Employment records of Adam Powledge.

B. Examination of the above facts and physical evidence leads to several conclusions and comments:

1. Mr. Adam Powledge was driving the Malibu Classic, Jacob Powledge was the right front passenger, and Isaac, Rachel and Christian Powledge were riding in the back seat. All occupants were wearing their seatbelts.
2. The Malibu Classic was traveling at a high rate of speed on southbound Interstate 45 in Texas City, Texas.
3. The following is Corporal Rich's description of the collision:

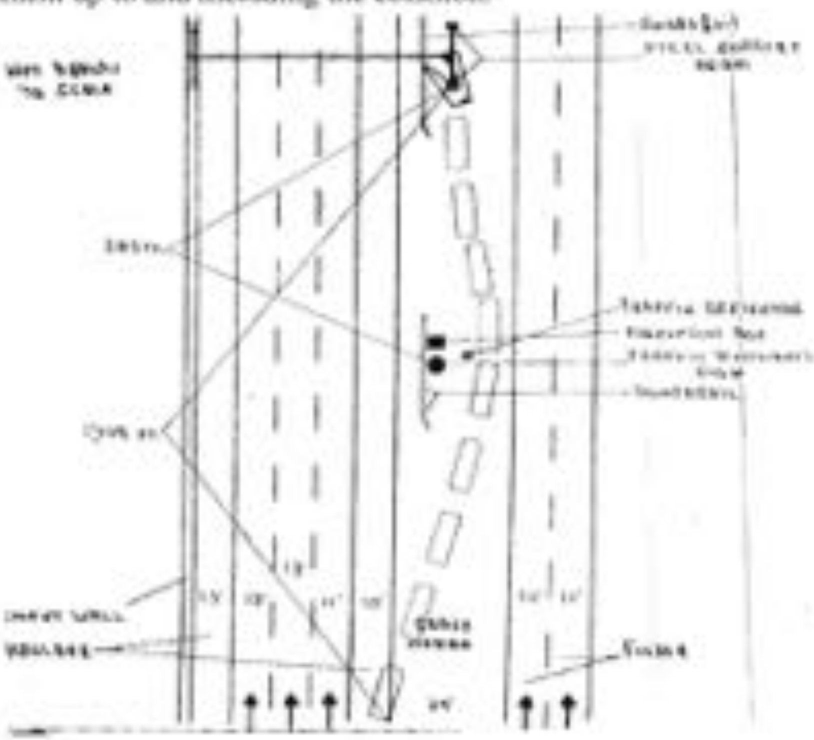
INVESTIGATOR'S NARRATIVE OPINION OF WHAT HAPPENED (ATTACH ADDITIONAL SHEETS IF NECESSARY)
Unit#1 had struck another unit while southbound damaging the other units
passenger side rearview mirror while on the freeway. TCPD case #05-10165.
Unit #1 then drove onto the grass median between the main lanes of the
freeway and the two lane feeder road. Unit #1 drove 1,419 feet in the grass
median from the time it left the main lanes of the freeway until it struck a steel
support beam for a traffic direction sign owned by the Texas Department Of
Transportation.
The vehicle split in half and caught fire killing all of the occupants.
It's unknown why the driver drove in the median for such a long time.

4. The accident scene was inspected by Dr. Mike Andrews and Kirk Parks at my request on April 17, 2008. Cones were put up to replicate the measurement information from the police investigation. Following the replication of the police measurements, police photographs were used to place chalk paint marks in the vehicle tire pathways that could be seen and utilized from the police photographs.

5. I asked if there could be a video taken from the driver's view of a vehicle while being driven in the identical pathway Mr. Powledge's vehicle made the day of the accident (with the exception of the left tires striking the concrete culvert). The video was ultimately recorded at 20 mph constant speed just up to the point of impact. I then had the video time frame compressed 4 to 1 to result in an 80 mph final driver perspective to better understand what Mr. Powledge experienced.

C. It might be natural to jump to the conclusion that Mr. Powledge was the sole cause of the accident, since he ran into a fixed object at high speed. However, jumping to this conclusion would be unscientific since it fails to consider the totality of the evidence. For example, it is my understanding that Mr. Powledge was taking four children to school on a Tuesday morning. It is also my understanding that Ms. Powledge will testify that her husband got a good night's sleep the night before, that he was not a reckless driver or a speeder, that he had no problems at work, no problems with his children, and no problems with his marriage. She is also expected to testify Mr. Powledge's health was good. Also it is expected that she will testify that Mr. Powledge was not suicidal and left no note or indication that he was planning such a horrible event. Lastly, based on a review of Mr. Powledge's medical records and employment records, as well as what I understand Ms. Powledge will testify to, Mr. Powledge had no suicidal indications or past mental illness history noted by any medical care provider. In fact, Dr. Kyler S. Knight concluded on August 1, 2005 that *"Adam Powledge is not at a higher risk for injury because of any ... mental disabilities."*

D. To determine if this was an intentional event, one must also look at the events before the actual impact. The police accident diagram illustrates the vehicle movement up to and including the collision:



E. The eyewitnesses indicated that the Malibu Classic was traveling 80-90 mph as it left the travel lane shoulder and entered the median. The impact damage to the vehicle supports that it was traveling at a high rate of speed. I believe that it would be impossible to accurately determine a closing speed or delta velocity using any type of crush measurements because the vehicle is simply too damaged. In fact, the vehicle was literally in pieces after the accident and upon being towed away from the scene. Further, there is no pole impact testing with a vehicle traveling at speeds approaching 80 mph that have been conducted on the subject vehicle. Therefore, there is no test data to correlate with the vehicle damage seen in the photographs prior to its removal from the scene. Lastly, using any type of computer program for this accident requires too many subjective variable inputs that can improperly influence the outcome.

F. Mr. Powledge was able to steer and control his vehicle and thus avoided striking several vehicles that were on I-45. He managed only to slightly sideswipe another Malibu side mirror to side mirror before leaving the travel lane of I-45 and entering the grass median. Damage to the other Malibu is shown below:

G. After his departure from the southbound travel lanes of I-45 into the grass median, Mr. Powledge was able to steer and control his vehicle such that he managed to avoid a guardrail, a large electric box, a reflector post, and a traffic information sign pillar by moving toward the opposite side of the median. Based on the initial travel path of the Powledge vehicle after the vehicle left I-45, it appears that Mr. Powledge was trying to get onto the feeder road.

H. Photographs provided by Laurie Williams that were taken by her husband Michael 7 days after the accident still clearly depict the tire marks made by Mr. Powledge's vehicle. The Williams' photographs and the Scientific Analysis photographs taken October 30, 2005 reveal that as Mr. Powledge reached the far side of the median after avoiding the obstacles described above, he contacted the top of a cement and steel drainage culvert with his left side front tire. This culvert was never photographed by the police or mentioned by the police in the scene diagram. The culvert has a sharp edge that is several inches tall. Measurements by Scientific Analysis taken on October 30, 2005, revealed that the centerline of Mr. Powledge's left front tire was 1.3' into the concrete culvert.

I. The concrete culvert edge damaged the left front inner wheel and punctured the tire. The wheel and tire damage affected Mr. Powledge's ability to steer and control his vehicle.

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J. The contact with the drainage culvert is evident in a police photograph where there is clearly a "curb strike" type dent in the rim and a large cut in the tire at the same position. This event would have rapidly deflated his left front drive tire and immediately pulled the Powledge vehicle back to the left (toward the middle of the grass median).

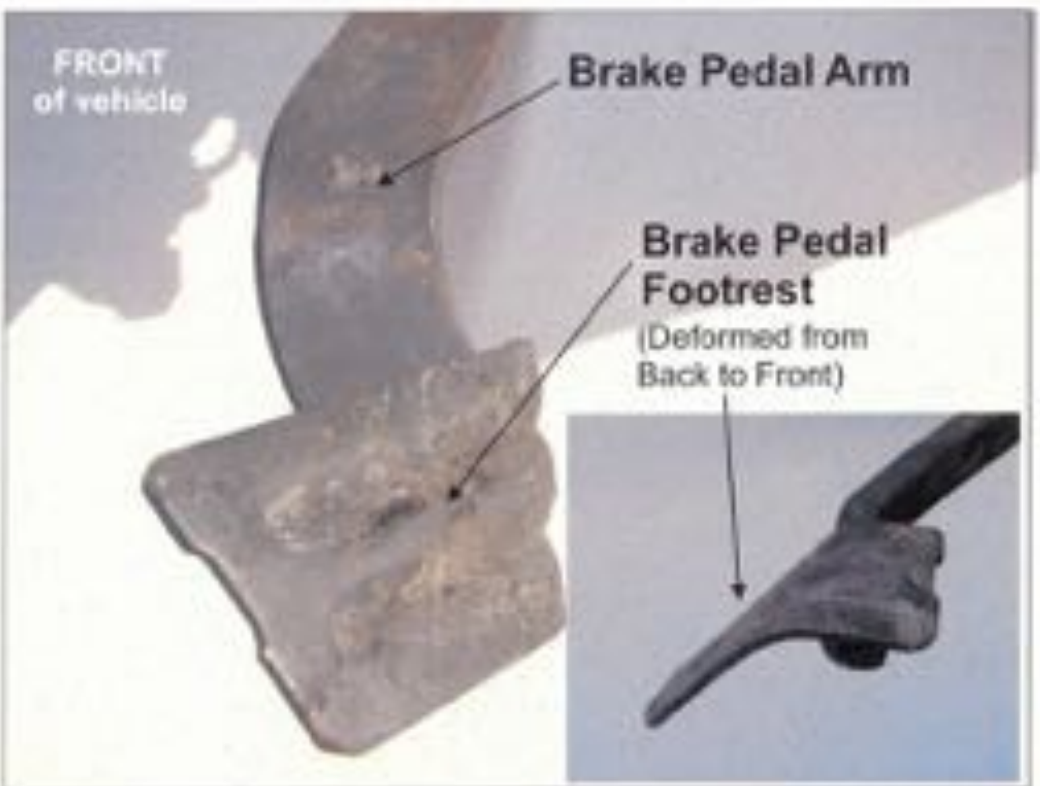
K. Scene measurements by Scientific Analysis regarding the grass median include: width 50'; west side slope is 7 degrees; east side slope is 10 degrees; depth is 2'; flow line is 24' wide. The sloped sides would re-direct Mr. Powledge's vehicle back to the center of the grass median and make steering even more difficult to the right (toward the feeder road).

L. The re-directed motion of the vehicle back to the left (middle of the median) is evident in numerous photographs. As Mr. Powledge's vehicle moved left toward the flow line of the median and the deflated tire and bent wheel affected his steering and control capability, these conditions would tend to straighten out the vehicle into the lowest portion of the median.

M. During the last 700' of this accident after striking the concrete culvert with the left front tire, Mr. Powledge's brakes were ineffective, his engine was racing and his steering was not overly effective since the left front tire was deflated and his left front wheel was bent.

N. Even though the deflated left front tire and damaged wheel affected Mr. Powledge's steering and control capability, there is evidence from the police photos that clearly demonstrate that Mr. Powledge's vehicle did not strike the sign support structure in a direct head-on manner. Instead, these photographs show that the impact was offset to the far left-side of the vehicle consistent with a person that was trying to steer around the obstacle.

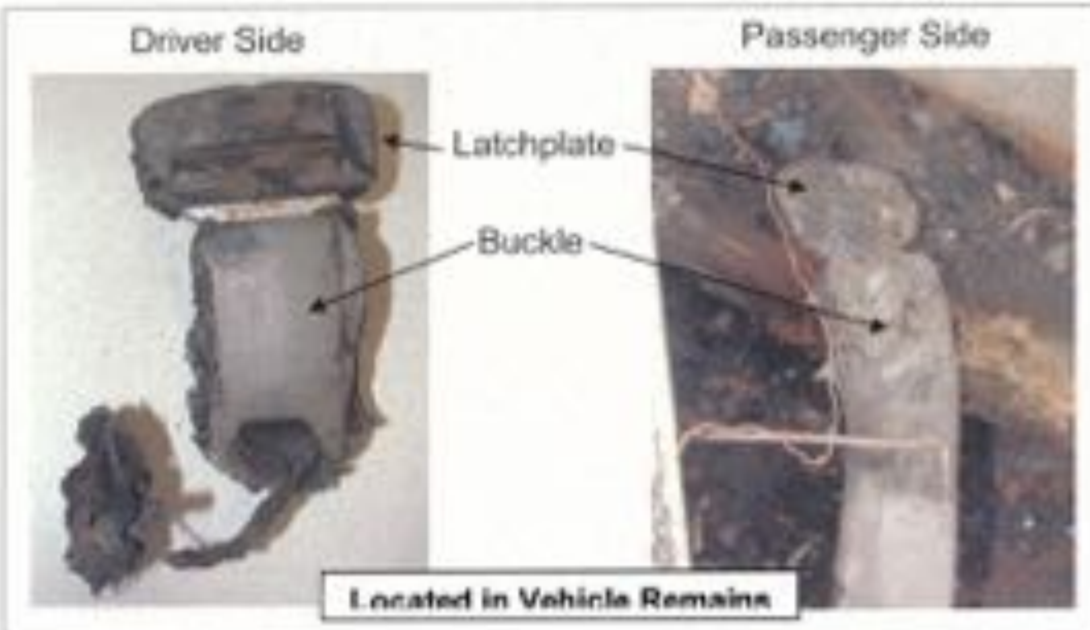
O. During one of my many inspections of the subject vehicle, the brake pedal was located. The brake pedal has significant deformation in the forward direction. In other words, the flat part of the pedal that your foot applies pressure to is bent from the rear to the front of the vehicle. This almost conclusively proves that Mr. Powledge had his foot on the brake pedal at the time of the impact. If Mr. Powledge was trying to commit suicide, it does not make sense that he would be applying his brakes at the moment of impact.



P. The left front brake pads on the subject vehicle were overheated, despite there being little or no fire damage to that part of the Malibu Classic. In fact, the rubber tires are still intact.

Q. The brake pad material is overheated and spalled, indicating hard brake/pedal application. If Mr. Powledge was trying to commit suicide, it does not make sense that he would apply his brakes to this extent before the impact.

R. The driver's latch plate and buckle was located among the debris. The driver's latch plate is still in its respective buckle. It does not make sense that a person predisposed to killing himself in a vehicle crash would buckle up for safety before killing himself.



S. Further, the buckle from the right front and one buckle from the rear seat were located in the debris. The latch plates were likewise in place in each of these buckles. Photographs taken by the police have the other two rear seat buckles documented. Again, the latch plates are inserted. It does not make sense that a man intent on killing all of his children would make them buckle up for safety before he killed them in a vehicle crash.

T. The police report indicates that seat belt status was "unknown." However, the evidence proves that all 5 occupants had their seat belts buckled at the time of the accident.

U. Lastly, the police photos show that the tire marks left in the median grass from the subject vehicle appear very heavy and defined. Photographs taken 7 days after the accident still show the distinct tire marks and the torn grass and disrupted soil. The subject vehicle, a front-wheel drive with anti-lock brakes, would have a tendency to drag the rear tires along, while braking under full throttle (the rear not subject to the engine driveline). The rear tires would, however, be rotating, disrupting and tearing the soil and grass surface more so than just traveling at a high rate of speed with no braking. By contrast is the Malibu, whose side mirror was struck by Mr. Powledge's vehicle during the accident that had pulled off into the median after being struck. The struck Malibu left no tire marks in the grassy median shown in the police photo, and we know it pulled onto the grass and ultimately came to a stop.

V. I also watched Corporal Rich's cruiser video and noted that two trucks had pulled off into the median on opposite sides while the Powledge vehicle was still on fire. The police photographs after the fire do not show that tire marks were left in the grass median from either of these vehicles even though we know they pulled onto the median grass and stopped.

W. I pulled the National Weather Service data for rainfall in the area to determine if the tire marks from the Powledge vehicle that were photographed by the police and the Williams' could have been due to wet ground. According to the two reporting stations for the National Weather Service for this area, there was no precipitation from October 11-18. (**Attachment B**). As such, the tire marks in the grass median cannot be attributed to wet ground conditions.

X. Knowing that there were at least three other vehicles that were clearly in the grass median, this begs the question, why didn't these other vehicles leave any tire marks in the grass median when the Powledge vehicle left such well-defined tire marks? The answer is simple. The Powledge vehicle's rear tires were braking while the front tires were accelerating. The other vehicles' in the grass median did not experience a similar condition as the Powledge vehicle. The fact that these tire marks are still present 12 days (date Scientific Analysis photographed scene) after this accident reinforce the dramatic nature in which the tire marks were made.

Y. Based on a reasonable degree of engineering probability, the totality of the evidence proves that this accident was not intentionally caused by Mr. Powledge.

VI. ANALYSIS OF AN UNINTENTIONAL ACTION BY MR. POWLEDGE SUCH AS MEDICAL CONDITION CAUSING THE ACCIDENT

A. Based upon my review of the medical records, and in addition to what I understand Ms. Powledge will testify to, there is no evidence that Mr. Powledge had any sort of past history of heart, stroke, or seizure conditions, or other medical conditions which would lead one to believe that some sort of medical ailment caused him to leave the roadway or caused him to be unable to control his vehicle. In fact, he had a complete medical checkup two months before the accident wherein he was cleared to go to work for a new employer. Specifically, Dr. Kyler S. Knight concluded on August 1, 2005 that *"Adam Powledge is not at a higher risk for injury because of any physical or mental disabilities."*

B. Additionally, it does not make sense that a man who was having medical trouble such as a heart attack, seizure, or stroke would be able to swerve to avoid so many obstacles, and also be able to push on the brakes hard enough to bend the brake pedal bracket and leave the type of long, defined brake marks in the grass median. Of course, as noted earlier, we know that the evidence strongly supports that Mr. Powledge was attempting to steer and stop his vehicle prior to impact. Therefore, because he was attempting to steer and brake, there is no evidence or reasonable inference to support the hypothesis that Mr. Powledge suffered from any medical condition which caused him to have the accident.

VII. ANALYSIS OF A DISPLACED FLOOR MAT/STUCK PEDAL/PEDAL MISAPPLICATION CAUSING THE ACCIDENT

A. I am familiar with claims by consumers, and NHTSA studies, whereby accelerator pedals have been depressed unintentionally due to a floor mat dislodging. I had Mr. Tracy check with Ms. Powledge to determine if this vehicle contained floor mats. It is my understanding that Ms. Powledge is expected to testify that the vehicle did not contain floor mats when the vehicle was purchased from Norman Frede Chevrolet in March 2005 when they bought the vehicle. No floor mats were ever purchased.

B. I also reviewed a recall for the 2003 model year Malibu that had been recalled for a stuck gas pedal. (Recall No. 22583856 pivot pin) The gas pedal design for the 2004 model year vehicle was compared with the earlier year vehicle, and I found it to be different in design. Specifically, there was no pivot pin used in the 2004 model year vehicle.

C. Based on no floor mats and the design change to the gas pedal assembly, I ruled out these as potential causes for the accident.

D. Even though the vehicle industry and the NHTSA routinely blame drivers for pedal misapplication, I also ruled out pedal misapplication, since the brake pedal was bent in a manner consistent with it being applied on the side furthest from the gas pedal.

E. Pedal misapplication can also be ruled out due to the brake pad spalling and disrupted grass and soil in the median.

F. The totality of evidence supports proper brake pedal application, not improper gas pedal misapplication.

VIII. ANALYSIS OF A MECHANICAL/ELECTRICAL FAILURE OR ENVIRONMENTAL CONDITION CAUSING THE ACCIDENT

A. Based on the tire marks in the grass median, the evidence is overwhelming that Mr. Powledge was braking at the time of the impact, and that he had been for a lengthy period of time before the impact. Naturally, the question becomes: why did his vehicle not stop?

B. Contrary to GM's position in its build sheet for this particular vehicle, and in its answers to discovery, the subject vehicle clearly does have ABS components in place. These components are only used on ABS systems and were connected to the vehicle's wiring harness.

C. In fact, the service manual for this vehicle shows that Malibu Classic vehicles with hub mounted speed sensors have anti-lock brake systems.

D. So why would the vehicle's engine be racing when the brakes were being applied hard enough to bend the brake pedal, overheat the brake pads and leave defined tire braking marks?

E. According to the testimony of GM's brake expert, Roger Newsock, a vehicle whose brakes do not properly stop a vehicle is unsafe. Specifically, Mr. Newsock opined, in *Flynn v GMC*, as follows: "*the vehicle is not intended or designed such that it will gain speed when the brakes are applied. It would appear that some mechanical malfunction is involved*" if the vehicle fails to slow down when a person is standing with both feet on the brakes.

F\. GM has had problems in the past with its brakes not properly stopping vehicles when a vehicle accelerates out of control. **(Attachment C).**

G. Mr. Newsock testified in *Flynn v GMC* that police units were reporting that their brake systems were experiencing hard pedal or no brake support. Mr. Newsock also testified in *Flynn v GMC* as follows:

Q. What are the specific incidents that you were involved in investigating?
A. I've been involved in two police car accidents in Indiana, and one in Ohio, Michigan, New York. That's all that come to mind at this time.

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Q. Did any of those drivers report to you that basically their brakes just failed to stop the vehicle?
A. Yes.
Q. Did any of them report to you that they had a hard brake pedal and the brakes wouldn't stop the car?
A. Yes.
Q. Are any of those incidents included in the documentation that have been brought to us here today, or do you know?
A. I don't know.
Q. Now, the officers reported to you that the brakes failed to provide normal braking action in combination with the hard brake pedal; is that right?
A. Yes.

Q. General Motors did not undertake that kind of analysis for the group of incidents, that you know of?
A. Not that I know of.
Q. About how many total incidents did General Motors have reported to it by police departments involving the police package Caprice where police said they did not get normal brake function?
A. I don't know.
Q. Did General Motors do any statistical work with regard to the police vehicles to determine whether the particular brake configuration that was used on that vehicle was overrepresented compared to other similar vehicles?
A. I'm not aware of any statistical analysis along those lines.

H. Since the subject brake pedal is made of thick steel that is bent, yet the vehicle struck the sign support while traveling at least 80 mph per eyewitnesses, this accident involves a brake system failure. The brakes failed to adequately stop the Powledge vehicle even though Mr. Powledge was definitely pushing on the brakes up to and includsing the moment of impact. Failing to properly stop a vehicle is a defect which renders a vehicle unreasonably dangerous and in violation of FMVSS 105.

I. I examined the remains of the vehicle to determine what was left of the power train. I found that both the engine and transmission had separated from their mount, and that both the engine and transmission had collision and fire damage. The intake manifold had either burned or broken off; however, the throttle body was located in the debris. It was stuck at the near full throttle position. There was a throttle cable connection, and a cable connection for a cruise control.

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J. I then inspected the power train of an exemplar 2004 Malibu Classic. The throttle was controlled by two cables. One cable attached to the throttle pedal, while the other attached to a stepper-motor type cruise control.

K. The 2004 Malibu Service Manual also indicates that, when a Malibu Classic is equipped with a cruise control, both accelerator pedal and cruise control input to the throttle are through pull-type cables. However, it should be noted that an exemplar 2004 Malibu built just 3 months prior to this Malibu Classic had drive by wire throttle system and integrated electronic cruise control.

L. There is a number of customer complaints from other Ecotec engine based vehicles indicating that this design occasionally results in an unwanted acceleration condition. (**Attachment C**.) Some of the complaints demonstrate that the throttle return spring, or other device to close the throttle (if the throttle cable, or throttle control electro-mechanical systems fail), is inadequate to close the throttle and prevent a runaway vehicle.

M. There have been numerous recalls of mechanical, electrical and environmental failures associated with "vehicle speed control" device failures over the years. (**Attachment D**). Here are a few:

- 1981 Buick LeSabre- accelerator pump lever pin loosed;
- 1984 Ford Mustang- secondary throttle shaft would stick in open position;
- 1986 Lincoln Continental- aluminum casting flash on the face of the throttle body was breaking off and trapped between throttle plate and throttle body;
- 1987 Dodge Dakota- speed control cable partially disengaged and would bind at the carburetor;
- 1987 Chevrolet Cavalier- accelerator cable may contain water that freezes which restricts cable movement;
- 1991 Jeep Cherokee- transmission throttle control rod spring improperly installed causing the throttle to close slowly;
- 1992 Pontiac Sunbird- a kink in the accelerator cable caused the accelerator control cable to stick;
- 1994 Buick Century- water in accelerator control cable makes cable movement difficult;
- 1994 Cadillac Fleetwood- excessive friction occurring in accelerator pedal assembly prevented engine from returning to normal idle speed.

N. If the throttle fails to close promptly when the driver takes his/her foot off the accelerator pedal, the throttle control system is in violation of FMVSS 124 (Accelerator Control Systems), both S5.1 and S5.3, which require redundant systems to close the throttle, and that the throttle close within a second after the gas pedal is released. If the cable guide moves off the throttle shaft, both springs disconnect from the throttle, and the throttle will not close. Such a single point failure is prohibited by FMVSS 124. An exemplar throttle body was purchased and disassembled to study the two spring connection. GM uses two springs that connect at the same positions. This unitized dual spring serves as the two distinct energy sources that FMVSS 124 requires to close the throttle. It is clear that GM's design of this unit is a violation of FMVSS 124 S5.1.

S5.1 There shall be at least two sources of energy capable of returning the throttle to the idle position within the time limit specified by S5.3 from any accelerator position or speed whenever the driver removes the opposing actuating force. In the event of failure of one source of energy by a single severance or disconnection, the throttle shall return to the idle position within the time limits specified by S5.3, from any accelerator position or speed whenever the driver removes the opposing actuating force.

O. A throttle control system, like that on the subject Chevrolet Malibu Classic, which does not meet FMVSS 124 is defective and unreasonably dangerous.

P. The cruise control for the subject vehicle was also studied to evaluate its propensity to fail. The vehicle industry has had numerous recalls for mechanical and electrical cruise control failures dating back to the mid-1980's.

- 1984 Oldsmobile Cutlass- cruise control cable may separate from the conduit end fitting;
- 1984 Corvette- cruise control vacuum solenoid valves may malfunction;
- 1984 Toyota Camry- cruise control computer malfunctions due to continuous exposure to cold ambient temperature.

Q. The subject vehicle uses a stepper motor type cruise control. The stepper motor cruise control has had numerous failures over its design and service life. GM stepper motor cruise controls have been reported to the NHTSA for unwanted acceleration problems. In fact, I downloaded the NHTSA database for reports on GM vehicles that have stepper motors and similar cable attachments as the subject vehicle where a complaint was registered for unwanted acceleration. (**Attachment C**). Many of these complaints sound eerily similar to the Powledge accident.

R. Stepper motor cruise controls are subject to intermittent electromechanical failure modes that have been documented for years. These include exposure to excessive heat and cold, moisture, open intermittent circuits and short circuits as well as failures associated with Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI).

S. The vehicle industry has known for years that sudden acceleration can occur when intermittent electrical malfunctions happen. A 1988 Japanese government study on unwanted acceleration found that *"continued analysis of and investigation of malfunctioning of the electronic devices taking into consideration not only electromagnetic noise but environmental conditions such as temperature, humidity, and vibration are needed."*

T. Intermittent electronic failures are recognized by the *Electronic Troubleshooting Handbook:*

> *Whenever too much heat is applied to electrical or electronic devices, problems occur. Heat increases resistance of circuits, which in turn increases the current. Heat will cause the materials to expand, dry out, crack, blister, and wear down much more quickly; sooner or later, the device will break down.*
>
> *Moisture (water and other liquids) causes expansion, warping, quicker wear, and abnormal current flow (short circuits).*

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> *Dirt and other contaminants, such as fumes, vapors, abrasives, soot, grease, and oils, are materials that cause electrical and electronic devices to clog or gum up and operate abnormally until they finally break down.*
>
> *Abnormal and excessive movement can lead to breakdowns; vibrations and physical abuse are the leading causes of these types of breakdowns.*

U. A study conducted by Boeing in 1988 evaluated automotive designs for GM, Ford and VW by using Boeing's "Sneak Analysis" technique for identifying and correcting reliability robbing design conditions called "sneaks" that frequently evade detection by traditional analysis and testing. Boeing found that one design in three in vehicles contained "sneaks" that would result in *"loss of system, loss of life, or major project delay because no 'work around' was available until the sneak condition was corrected."* One component Boeing found that was subject to "sneaks" was the cruise control module.

V. The microprocessor manufacturer for this particular cruise control (Phillips) describes in their chip data sheet that the absolute maximum operating temperature for this chip is 250 degrees Fahrenheit and anything beyond that range would cause single or multi mode failures.

[illegible]

[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]

Phillips Chip on Exemplar Cruise Controller

W. However, as noted below, engine temperatures under hood routinely get above 125 degrees Centigrade (260 degrees Fahrenheit.)

X. Other electronic circuitry components are designed for the harsh environment experienced under hood.

Use of vehicular electronic stability controls is growing. A new quartz MEMS gyroscope can handle the harsh under-hood environment, where temperatures exceed 125°C and shock and vibration are significant.

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By: [illegible]

sensors

Y. Failing to properly locate, shield, protect and/or insulate a cruise control module is a defect that renders the vehicle unreasonably dangerous because the circuitry can be corrupted, which affects performance.

Z. Based on a reasonable degree of probability, I believe that a mechanical/electrical or environmental failure in the design of the throttle body and/or cruise control system occurred which caused the Powledge vehicle to experience unwanted acceleration. A manufacturing defect also existed in that improper testing, analysis, evaluation and real world environmental impact study was not conducted as I discuss in section **XI** below.

AA. The brake system was then incapable of stopping the vehicle while its engine raced out of control. In reviewing the NHTSA database, many people have reported that their vehicle accelerated out of control after the brakes were applied. Still others reported that the engine continued to accelerate after the brakes were applied, and others reported that the brakes did not stop the vehicle properly during an unwanted acceleration. (**Attachments C, D**).

BB. This unwanted acceleration and inability to stop was the producing cause of the loss of control of the vehicle and its ultimate accident.

IX. ALTERNATIVE DESIGNS RE ENVIRONMENTAL/MECHANICAL/ELECTRICAL FAILURES

A. Throttle control system that actually meets FMVSS 124.

B. Drive by wire and integrated cruise control module, as used on the Malibu that preceded this vehicle by 3 months.

C. Ignition cutoff under panic braking conditions.

D. Fuel cutoff or fuel restrictor device.

E. Relocate cruise control module so that it is free from EMI / RFI contacts, hot and cold temperature fluctuations as well as moisture and pollutants.

F. Redundant fail safe designs so in the event of a failure, there is a "work around" system to prevent loss of system control.

G. Speed sensitive acceleration cruise control based on European Patent 1375233A1.

H. Police package braking system like on the Caprice and Roadmaster.

I. Hydraulically assisted ABS brakes like those used on 2004 Silverado pickup.

D. The safer brake, throttle and/or cruise control system designs to resolve or guard against the brakes failing, the throttle sticking, the vehicle speed control system failing and/or the cruise control module failure are not cost prohibitive and affect neither the function nor the appearance of the vehicle. These design alternatives were both economically and technologically feasible to incorporate into the 2004 Chevrolet Malibu Classic and would most likely have prevented the Powledge family's fatal loss of control accident.

X. IDENTIFICATION OF RISKS, HAZARDS AND DANGERS

A. A safety engineer's primary responsibility is to identify potential risks, hazards and dangers associated with reasonably foreseeable uses and misuses of a product. Then, he should attempt to design out the dangers, guard against them or, as a last resort, warn about them. This is known as the engineering triad.

B. GM's engineers should have used one of the many available techniques to analyze the safety of the Malibu brake, throttle control system, vehicle speed control and/or cruise control system.

C. GM should have used a similar Sneak Analysis as described by Boeing in its analysis of the vehicle industry. I have seen no Sneak Analysis on the throttle control, speed controls or cruise control components.

G. GM should have analyzed the risks of the throttle failing to close, the vehicle speed control failing, the cruise control failing or whether the brake system could properly stop this vehicle if an unwanted acceleration occurred. They, apparently, failed to do so. In support of this position, I have seen no documented FMEA, DFMA, fault tree analysis or any other similar analysis on the subject components. This would explain why the NHTSA has had so many reported claims of unwanted acceleration with this design throttle/cruise control system.

H. In 1999, the University of Maryland published a paper on factors affecting cruise controls. The study found that many cruise control modules are exposed to operating heat far greater than what they can handle. However, the study found that cruise control modules were not being properly tested and evaluated by the vehicle industry to study real world environments. The study recommended that vehicle manufacturers adopt a Physics of Failure (PoF) approach which is a five step methodology:

1. PoF based virtual qualification is used to identify the product configuration, life cycle loads, and preliminary assessment of potential failure sites, damage mechanisms, and failure modes;

SYSON-HILLE and ASSOCIATES

2. Accelerated stress test planning including load detection, failure detection, and response monitoring analysis;
3. Overstress limits are explored in a vehicle environment;
4. Accelerated life testing based on step 3; and
5. Correlate accelerated stress tests results to field life estimates.

I. I have seen no PoF analysis conducted by GM of the speed control system, cruise control module or braking system for the subject vehicle.

XI. CONCLUSIONS

A. The Ecotec power train, like that used in the 2004 Malibu Classic, is unreasonably susceptible to vehicle speed control failures, which dealers are often unable to diagnose or cure. **(Attachments C and D).**

B. Since the subject 2004 Chevrolet Malibu Classic engine's throttle control system is presently stuck 70 to 80% open, the throttle control system fails to meet FMVSS 124. Failure to comply with FMVSS 124 is negligence per se.

C. The cruise control on the subject vehicle is mounted so close to the engine and engine components, exposure to all of the heat, moisture, and excessive vibration can create just the type of environment to produce a failure. That failure may be inoperability or a permanent opening of the throttle body in a multi-mode failure. This location, lack of shielding/insulation can cause an environmental, mechanical or electrical failure.

D. The brakes are incapable of stopping the vehicle when the throttle, speed control or cruise control malfunctions and the vehicle experiences unwanted acceleration.

E. The brake system, throttle control, vehicle speed control and cruise control system is defectively designed and manufactured for the reasons stated above.

XII. SUMMARY

A. A vehicle throttle control system, speed control and/or cruise control that experiences unwanted acceleration makes a vehicle defective and unreasonably dangerous. Failing to properly test, evaluate, analyze and study the components in real life vehicle environments is a manufacturing defect.

B. A vehicle whose brakes fail to timely stop the vehicle when unwanted acceleration occurs is defective and unreasonably dangerous.

C. The driver has limited time and control options. For example, he could turn off the ignition, leaving a vehicle that is very hard to brake and steer, and has limited electrical power.

D. One must also consider the effect of panic in this situation from the driver to the passengers, the movement of the vehicle due to evasive action, the movement of the vehicle after it struck the concrete culvert, the movement of the vehicle after the left front tire deflated and left front wheel bent, and the consequences of the noise associated with the racing engine, out of control vehicle and screaming from within the vehicle during the 12 seconds prior to impact with the sign.

XIII. BREACH OF WARRANTY (EXPRESS OR IMPLIED)

A. Consumers expect that their vehicle will not race out of control.

B. Consumers expect that their vehicle will not experience unwanted acceleration.

C. Consumers expect that their braking system will stop their vehicle.

D. When the subject vehicle raced out of control and would not stop with the brakes applied, the subject vehicle failed to perform as expected.

XIV. COMPLIANCE WITH FMVSS

A. Defendant may argue that its vehicle complied with all applicable FMVSS provisions. I disagree that the subject vehicle complied with the FMVSS 105 and 124 for the reasons stated no matter what GM's compliance testing shows.

B. However, even if the vehicle met the standards, the preamble to the FMVSS clearly states these standards are minimal in nature.

C. Compliance with FMVSS does not mean a vehicle is free of safety defects. In fact, millions of vehicles, tires, and child seats have all been recalled due to safety defects even though they complied with all applicable standards.

D. In certain years, there are more vehicles recalled, than actually sold.

F. The FMVSS are inadequate to protect the motoring public. For instance, FMVSS 206 fails to evaluate door hinges or door performance in rollovers or when vertical forces are incurred. FMVSS 207 fails to evaluate the weight of an occupant. FMVSS 208 fails to consider any affect on the neck, face, internal organs other than heart or any body structure below the knees. FMVSS 213 fails to evaluate child seats in side impacts or rollovers. FMVSS 216 fails to evaluate roof strength while a test dummy is in place. FMVSS 124 was enacted when engines were carbureted. Most of the FMVSS do not even require dynamic testing.

G. The standards fail to adequately evaluate vehicles under real world conditions. Laboratory test conditions are not the place to test a vehicle. A vehicle should be tested in its real world environment.

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H. If the subject vehicle was tested under real world conditions, the components discussed in this report would fail to comply with even these mediocre safety standards.

This report is subject to amendment and supplementation subject to a review of additional documents to be produced by the defendant in this matter. Further, I would like the opportunity to comment on any reports provided by the defendant in this matter.

Sincerely,

Stephen R. Syson
Syson-Hille & Associates

ATTACHMENTS:

A. Curriculum Vita
B. Weather Service Data
C. Stuck Throttle Database from NHTSA
D. NHTSA recalls on speed control defects
E. Other supporting materials referenced in the report

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